SUPPLEMENT.

The Mining Journal,

RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

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ON—ITS COMMERCE AND APPLICATION TO STAPLE MANUFACTURES.

BY CHARLES SANDERSON, ESQ.

[*Concluded from the Mining Journal of May 8.*]

propose the use of iron and steel united in a bloom, and subsequently rolled to a , hardened and tempered in order to obtain the maximum amount of rigidity com- with strength, as a material for the formation of steam-ships; and it will be found ly useful in the erection of tubular bridges, and many other engineering purposes.

these days of steam navigation, I would request of those who are engaged in build- ron steam-ships to investigate the usefulness of such material, and to inquire into st. No doubt it may be expected to be expensive. I am enabled to state, however, it can be produced at a sufficiently low price to ensure its use, and whatever increase may be in cost will be more than compensated for by the difference of weight re- d of this material contrasted with that of iron.

e value of puddled steel has recently been brought under your notice. I can add to the opinion I then expressed; the process will certainly produce steel, but from nature of the operation itself, it must be evident that the quality is continually sub- to great irregularity. All agree that the greatest care is necessary to produce it. uniformity may be obtained by breaking up the rough bars, selecting them when and welding them together; still the mass is simply steel combined with fine fibres n intimately intermixed. It will become a useful metal for a great variety of pur- where a cutting edge is not required, but looking at puddled steel as a raw material manufactured by the peculiar process which has been described in the patent, I think that if refined metal were puddled, shingled, and rolled to a bar, and then con- d into steel by the usual process, a cheaper and more uniform material would be ned. I take this opportunity of repeating that the conversion of bar-iron into steel t not to cost more than 18*s.* per ton. My calculation is drawn from careful accounts of the working of ten converting furnaces for five years, during which period one- of the iron was converted for hard melting purposes. From this I positively affirm the conversion of puddled bar-iron, in order to give it as much steel character as possessed by puddled steel, ought not to cost so much as 18*s.* per ton, including every r expense.

me engineers have objected to rails, even if made from cast-steel. They say no de- ence can be placed upon such a material, because it has no toughness. Its crys- ne fracture is objected to on account of brittleness, especially in very cold climates. form of rail which I have submitted to you might, of course, be made wholly from steel, I object to this material, because rails are subject to sudden violent concussions, ch might snap a steel bar, and thus place the line in danger.

r some time past our scientific journals have been filled with various projects for production of steel, especially cast-steel, at very cheap rates. After all the apparently ible projects which have been suggested, nothing of any importance has yet been done tain this object; the steel which has been produced by these various processes does appear to possess that quality which has been so positively stated; hitherto cast- l has been made varying from 65*l.* to 30*l.* per ton, each quality being practically use- for the manufacture of steel articles. The manufacture of such steel has hitherto the peculiar province of the Sheffield makers, but let it not be supposed that they can e no other material than that used by the cutler, the tool maker, and the engineer; hem see that a want is created for a steel suitable for the manufacture of shafts, m-ships, tubular bridges, and other like purposes, where strength and rigidity are the cipal acquirements, it will be found that they are the best able to suggest modes for ducing such an article, of uniform quality, and at a cheap rate. Science can greatly st art in producing the kind of steel required for general engineering purposes; and ly as I esteem this combination I would earnestly advise the practical metallurgist not ome to hasty conclusions from laboratorial experiments. With the metal steel is clated the idea of great expense; good steel will always sell at a price consistent with intrinsic quality, and if care, skill, and expensive raw materials be required to pro- e such a steel, an adequate price will always be found for it; but if, on the other d, a metal be required combining within itself a much superior strength and rigidity n iron possesses, I feel no hesitation in saying that it can be produced by the large l manufacturers of Sheffield at a cheaper price and of better quality than by any of peculiar processes patented within the last few years; although I do not think that ocess is yet discovered which secures the minimum cost price of the production of such terial, yet this enquiry is going forward, and will, doubtless, be speedily arrived at. ether such discovery emanate from existing steel-makers, or from others not engaged his trade, its production at a cheap rate will confer the greatest benefit, not only n our railroad requirements, but also upon our steam navigation; we may then hope ave better and more efficient rails, stronger bridges, and safer steam-ships.

s regards the direct conversion of pig-iron into malleable iron or steel, without the dling furnace or charcoal refinery, I have already expressed a strong opinion when t process was first proposed at the meeting of the British Association, at Cheltenham. ill see no cause to change the opinion I then expressed, that neither practically useful leable iron, nor cast-steel, could be produced direct from pig-iron. It is by no means mmon practice to use refined metal (which is decarbonised pig-iron) as a mixture h any common material, such as scrap iron, clippings from old boiler plates, and the , to produce a common cast-steel, which is sold at from 16*l.* to 18*l.* per ton, for mak- mill saws, and several very common cast-steel articles, but the only quality as a el which it possesses is, that it will harden and temper.

When it was found that the decarbonised pig-iron, resulting from the process of blow- a strong blast of air into a body of fluid iron, would not roll or draw under the hammer, . Robert Mushet patented several processes with a view of rendering this product malle- e; manganese, mixed with carbonaceous matter, is suggested by him as a means of obtain- malleability; he asserts that he can operate upon 1 or 20 tons of fluid metal, by blowing rong blast into it, and when, by this means, it is decarbonised, by adding from 2 to per cent. of manganese and carbon, he professes to change a brittle metal into one pable of being rolled or hammered, hardened and tempered. There is a sample of Mr. ushet's steel, but I have no information whether it has been produced in the manner scribed, or whether he has had recourse to the crucible to remelt this metal.

A patent was taken out a short time ago for mixing decarbonised metal with malleable n; this process was first carried out at some cast-steel works belonging to Prince hwartzenburg, at Muraw, in Styria; the late Mr. Heath also used it at his works at elsea; in both these instances, although the finest charcoal metal was used, yet a good ality of steel was not regularly produced; as a manufacture, the process was imperfect. Patents have also been taken for the production of cast-steel from iron ore; many ex- riments have also been tried, both in England and France, to produce a cheap steel from ch an inexpensive material; by Monsieur Chenot's process, the iron is separated from her deleterious matter by an electro-magnetic machine; to the material so obtained a ick lime water is added, to prevent the particles sticking together and forming a com- ct mass during the process of deoxidation, which is performed in small perforated iron ssels, by passing through it a current of carbonic oxide gas; this deoxidised spongy ass is then steeped in any kind of fatty matter; from this source he says he obtains e constituents of steel; he proposes also to condense the spongy matter by pressure, d submit it to the usual process of cementation; it is then to be melted into cast-steel. There has been much said respecting a process for producing cast-steel from a mix- re of spathose iron ore and granulated cast-iron; but from the reasons I shall shortly y before you, I think no successful or practical result will be obtained.

Sir Francis Knowles has also patented a process for making cast-steel from iron ore; e says that if the complete success of the process be doubted, it is impossible to deny that rests upon a theory both rational and consistent with chemistry; he looks upon the anufacture of cast-steel from British materials as of national importance, by rendering independent of Sweden, or any other country. There is before you a complete set of amples of this steel, also a variety of manufactured articles, from which you can judge of he progress which he has made. His theory is as follows:—If the oxides of iron be laced in a closed retort or crucible in contact with charcoal, and submitted to adequate eat, the metallic part, as soon as it is deoxidised by the charcoal, begins to absorb car- on, and is, in fact, converted; if then no more charcoal be admitted than is exactly fficient to deoxidise the ore, and to convert the metal to the required temper, it is plain hat the absorption of carbon will then cease; and if at this stage the heat be gradually aised to the steel melting point, the production of steel must be the inevitable conse- uence. In sending the examples I am enabled to exhibit, he observes, in order to adjust he charcoal, we must know how much metal there is in the ore, and what is its state of xidation; preliminary chemical analysis will settle this point. The next step is so to adjust he fluxes that protosilicate of iron may not be produced, and for this purpose chemistry ust determine what earths are contained in the ore and the fluxes—a calculation must hen be made, so that the aggregate may be a combination of the silicates of alumina, ime, magnesia, and the potash of the charcoal used. Magnesian dolomite calcined is referable, in its absence the purest lime is to be used; the other flux he uses is kaolin, which is so rich in alumina; there is an additional value in this, as it prevents the corro- ion of the pots, when in proper quantity. The best ratio of the earths is three silica, wo alumina, two lime; samples of the cinder are here for inspection, being pure and ree from protoxide of iron. The most striking feature of this "ore steel" is its very reat density; this he ascribes to the total absence of the protosilicate of iron in the inder. Amongst the articles is a chisel, taken from an ingot, merely ground and har- ened and tempered, it has cut to pieces a bar of file steel. This striking property has led to its employment for the cogs of wheels and other important purposes. He also uses he Greenland cryolite, and cyanides of sodium and potassium, as fluxes. He has also ontrived a furnace or cupola for making steel by this process; it resembles an ordinary last furnace, except that the materials, mixed in proper proportions, are carefully secluded rom the fuel, and descend through a long pipe of refractory fireclay, and through the arious degrees of heat required, to the hearth of the crucible. Whether steel can be directly cast into ingots from such a furnace is at present doubtful; but there cannot be a doubt that a steel metal will be obtained. Sir Francis Knowles does not disuse altogether the present method of conversion, on the contrary, his opinion is that for certain purposes it is the best and most economical, as for some of the milder tempers—but whenever the operation of melting is required at an intermediate stage, there he would substitute the direct method, and above all, for cutting tools, of every description, and the highest class of cutlery. Such is Sir Francis's own statement.

The foregoing are the prominent processes which have recently attracted public notice, having for their object a reduction of the prime cost of making cast-steel.

At regards all steel produced by the decarbonisation of crude iron, if we examine the peculiar state of this metal it will be found that the mass is composed of atoms irregularly decarbonised and impure; besides which we find in such masses of metal a variety of combinations, all of which are opposed to malleability, because the aggregated molecules of such mass are not homogeneous, but are mixtures of metals existing under different chemical circumstances, which give to each molecule a different crystalline structure, so that, when heated, they expand unequally. All these opposite and conflicting states in which decarbonised pig-iron is found, prevent the mass from drawing or rolling. If lumps of iron are drawn from the puddling furnace a little before the mass is balled up, a bright and crystalline metal is obtained, similar to this decarbonised crude iron; it is partially malleable, but it has no fibre to recommend it as an iron, nor has it carbon to entitle it to be called steel. Mr. Mushet has evidently the idea that the addition of his compound will produce one uniform crystallisation, favourable to malleability, and he appears to expect that an alloy will be found of metallic manganese with the iron, but analysis has shown that no such alloy does take place. Manganese, added to steel, in the crucible acts simply as a detergent; it cedes its oxygen to the silex which the silicates of the metal may contain, and oxidises it, a union then takes place, producing a silicated oxide of manganese, in the form of a glassy slag; the metal becomes thus purified, because all foreign matter is separated, forming new compounds, which cannot again unite with it. If any attempt is made to produce cast-steel from decarbonised pig-iron, it must be broken up when cold, and such reactives added to it when charged into a crucible as shall take up the deleterious matter and liberate the metal, which must be kept in a fluid state for a long time, until every particle is reduced to the same chemical condition, and thus rendered more favourable for malleability; but this is so nice an operation, and so dependent on uncontrollable circumstances, that it is not reduceable to practice.

As regards all these processes which have for their object the manufacture of cast-steel from iron ore, I may in part advance the above theory against their success, but there is another cause which operates very unfavourably. Iron ore may be deoxidised and used as M. Chenot proposes, or it may be charged into a crucible along with carbonaceous matter and fluxes, and slowly heated until deoxidation takes place; when the cementation is complete a mass is obtained in the crucible consisting of earthy matter intimately mixed with steelified metallic particles, all of which have to be melted down in one mass. I think no one can reasonably assume that all these metallic particles, intimately mixed as they are with the earthy matter, can be in the same chemical condition, nevertheless the metal must all be melted down in this imperfect state; the metallic part more or less carbonised and mixed with foreign matter falls to the bottom of the crucible simply from its superior specific gravity; in order to give every chance for the matter to clear itself and become uniform, it might be kept in a melted state for some time, but for all this the operation carries with it no certainty either as regards quality or temper. I manufactured a ton of ingots from a very pure black oxide of iron; using every care, not more than 7 cwts. could be drawn into bars at all, and the fracture was very irregular, which may be observed in the sample; a part of this steel would not draw, but broke in pieces, the rest drew more or less imperfectly, and, on a careful examination I found it very evident that the chemical condition of the metallic particles was so dissimilar that malleability could not be depended on. In order, or as far as possible, to prove this assumed case of irregular malleability, I took soft steel in one crucible and very hard steel in another, and mixed with each a quantity of earthy matter, as nearly as possible to imitate the condition of the iron ore when melted; when they were completely melted they were intimately mixed together, and an ingot was cast, but although very carefully heated, it would not draw; this was not because an earthy matter was mixed up with the metal, but because its carbonisation was variable throughout the mass, which gave rise to such a confused diversity of crystallisation, and caused so great a difference in the degree of malleability in the atomic structure of the mass, that the action of the hammer at once broke up the ingot; the want of tenacity or disaggregation of the mass is often seen in large ingots, although made from good material; this is caused either from the irregular temper of the steel used, or from its having undergone a complete change in the crucible by overheating it and thus causing a mixed crystallisation; or it may equally arise from being under melted, which it is evident would produce the same effect. As I have stated, ingots of cast-steel can be produced directly from iron ore, but the best portions harden very irregularly, while the mass is usually so imperfect as to be unmerchantable. I admit that a cheap metal may be produced, but as I have shown that there is no certain result to be obtained in its manufacture, so also there is no economy. I will not assume that those who have been so sanguine in the production of cheap steel can have expected to produce a superior quality suitable for the best purposes; I cannot suppose such to have been their object, but rather to obtain a cheap material in a fluid state, capable of being cast into large masses for engineering purposes, or objects which are now manufactured from malleable iron, such as shafts, beams, girders, plates for ships, bridges, &c. In a commercial point of view England is the only exporting country to any extent. Sweden sends to England about 30,000 tons annually for steel purposes; she also exports largely to India and North America. Russia also exports to England about 10,000 tons of steel iron; a portion is sent to the United States in bars and in sheets, which are manufactured by a peculiar process; the rest of the produce is either consumed within the empire, or finds a market in Asia Minor and the East. Prussia has, within a few years, largely increased her production, and still continues to expand; she has not, however, exported her produce, but, on the contrary, has required considerable importations of pig-iron; for in 1857 she received from England 67,297 tons, against 39,296 tons sent in 1856, being an increase of 28,001 tons, and equal to 67½ per cent.

France does not appear to have made any advance since the alteration in the tariff admitted English iron at a reduced duty, which all her ironmasters are now seeking to repeal; it will, of course, become a national consideration, whether they are to hold the monopoly they seek, or whether the manufacturing population are to maintain their position—since the cost of iron in most countries is now becoming, as it were, the standard of its riches. In 1856 she imported from England 84,923 tons of pig-iron; in 1857, 89,401 tons, making an increase of only 4478 tons; whilst of rails and bars, in 1856, she imported from us 71,344 tons, and in 1857 only 30,136 tons, showing a large decrease of 41,208 tons. In the United States, although many of their ironworks are not in operation, and others, like our own, at present doing very little, yet, in the early part of last year they were producing one million of tons of pig-iron per annum, and from their vast mineral resources they will again, after a time, go on increasing; they do not export—on the contrary, in 1856 imported 58,500 tons of pig-iron; in 1857, 46,752 tons, showing a decrease of 11,748 tons; again, in rails, bars, &c., in 1856 they imported 231,555 tons; and, in 1857, 221,430 tons, showing again a decrease of 10,125 tons. In sheets, plates, &c., in 1856, 45,714 tons were exported, and in 1857, 46,497 tons; giving a small increase of 783 tons. On the whole, therefore, it appears that their own resources have reduced the import in 1857 to the extent of 20,000 tons; this reduction may, however, have partly arisen from the existing state of their public works and general trade.

The exports to all countries, for the first three months of the present year, show a decrease upon 1857 of 149,021 tons. The decrease has been chiefly to the United States, being 118,236 tons out of the whole. The total decrease of our exports this year is 31 per cent., equal in money to 1,447,479*l.*

If, then, we take a review of the iron produced in different countries, we find that the charcoal iron produced all over Europe is either consumed in the country where it is made, or sold to neighbouring states. Prussia, France, and the United States, alone make iron from coal or coke, but they do not export. England stands alone; her immense product supplies the want of every kingdom and nation. How is it that we have secured a position over all other countries, which enables us not only to supply iron cheaper than they, but also to pay the expense of transit, import duties, and a variety of other charges, and still compete with their own producers in their own markets?

We are fortunate in possessing large deposits of ironstone and coal, but we are still more fortunate in possessing the highest intelligence, an industrious population, and unlimited pecuniary means for carrying out the production of iron upon the most extended scale. In mining, in the management of the blast furnace, and in all the various processes for the production of malleable iron, knowledge has been added to knowledge, experiences have been so multiplied, and the system of iron making is now so perfect in itself, that by the statistics of the British iron trade we find England exporting iron and articles made therefrom to the enormous amount of 22,994,671*l.*, finding employment at home for a large industrious population, and supplying freight for our own merchant navy. This state of thinks will not only continue to exist, but our exports must continue to increase, so long as by our industry, capital, and knowledge we continue to produce iron at so cheap a rate. Improvement in quality is highly important, if it can be combined with the economy now practised, and must give an additional security to our commerce. Ironmasters may say, our plate-iron and our rails are good enough; I fear such an assertion could not be upheld; our rails, generally speaking, are not so good as they can be made, and the almost daily reports which we hear of the defects of our iron built steam-ships, are proofs that this kind of iron might be improved, and this can only be done by giving the maker a better price. I am perfectly aware that to maintain our supremacy over other countries the most rigid economy is necessary; but if our large ironmakers hope for prosperity, and if those who embark such large sums of money in iron establishments look for a manufacturer's profit, they must be careful how their money is expended in mines, machinery, and general works; thus must avoid the incubus of a heavy dead capital. Certain works may be able to produce 1000 tons or more weekly, and I will admit (for my argument's sake) that the strictest economy is throughout observed, from the raising of the ore and coal, to the dispatch of the finished iron; but upon all the various costs and charges which belong to the production of the iron the interest upon a large amount of dead capital has to be brought into calculation, at such a rate as shall not only cover common interest, but also the wear and tear, and the yearly diminution in value of works in operation. I will not venture an opinion how heavily they bear upon some large works, nor can I say how much capital has been irrecoverably lost, for want, at the outset, of a clear knowledge of all the requirements of iron-works; but I know that such an item does fall very heavily upon each ton of iron produced. Were it in my power to look back into the private history of many large works from their early commencement, and gradually to trace the expenditure of their capital, I should find large sums devoted to projects of which no vestige now remained; whilst the erection of the requisite machinery had cost more than double its original estimate. If such works were to be sold at a price ascertained by a fair valuation, perhaps that which by degrees, one way and another, had cost 500,000*l.* would be found not to be worth half that sum. If iron-works are intended to pay, their projectors must bear in mind that every 1000*l.* sunk in the works, &c., will eventually inflict a charge per ton upon their produce; and the smaller such produce is, the heavier will this charge become. If, therefore, capital be recklessly dissipated, it may soon be discovered that the interest and annual depreciation will sweep away all profits, because the number of tons of iron annually made will not bear so heavy an additional charge upon their actual prime cost of manufacture.

Much might be said upon the position of works, but the cheap transit by railway of raw material renders this less a question of importance than formerly; the economical erection of large works is a matter of very serious consideration; the means necessary to produce a required result should be well matured before they are acted upon, and applied with the greatest economy. Careful and circumspect management is imperative in every branch of this manufacture, when we bear in mind that everything which falls short of the standard of economy (by which I mean all the calculations of cost in the manufacture of the iron) is a dead loss. And, whilst I refer to the manager, let me not forget the workman. If this useful portion of our population contribute so largely to the profitable investment of capital, it deserves, and ought to have, a large share of consideration, both from the owners and managers of iron-works. We must acknowledge that they perform their work with an intelligence and physical energy equalled by no other nation. Besides the common operations in iron-works, a vast amount of skilled labour is continually required; these talented workmen secure to us that manufacturing pre-eminence we enjoy, and it is this union of action, this chain of circumstances, which has raised our staple manufacture to its present state of prosperity. Let, then, our labouring classes be cared for; if they give us their labour with free minds and willing hands, secure to each family a comfortable home; provide the means for a sufficient amount of education to their youth, and of offering up their united thanksgiving to their God. Whilst those exercising authority must at all times maintain their position towards the workmen, and insist upon order and regularity, I feel, because I know from experience, that a master whilst he acts with firmness and decision, can and will command the respect, the unrelaxing duty, and, I may also add, the attachment of all those who work under his direction; but such a master, to enable him properly to direct others, must know his business, and he must in all his acts make every man feel that he is able to detect the smallest neglect of duty.

When a nation has made rapid strides in any branch of manufacture, it is not surprising to find a natural as well as a laudable desire to follow in the same path. Whilst England may, at present, look round with some security upon the efforts of other countries, do not let us forget that amongst other nations, as well as our own, knowledge daily expands, and will lead them gradually and imperceptibly not only to imitate that perfection which we have attained, but also to add their own improvements. The progressive developement of our mineral riches, particularly of our coal and iron, forms a formidable item in the estimate of our national wealth, it increases our importance as a manufacturing people, and strengthens our relative position with other nations, as well as in our colonies.

Whilst we are engaged in laying down that mysterious link of intelligence with the western hemisphere, let us not forget our own immediate requirements; we have the power, let us also have the will, to bring our eastern metropolis in direct communication with the rulers of that vast empire at home; let us hope to see her rivers, which everywhere stretch their arms throughout this land, teeming with riches and prolific vegetation, covered with light-draught steam-boats; let railroads open out the immense resources of a country which has successively enriched many European nations, and England's wealth and energy will then draw from this long-neglected portion of our empire those benefits which she ought long ere this to have enjoyed.

Sir,—I notice some observations made by "Eisenstein," in your Journal. I beg to refer you to the *rationale* of my refining process, which I have sent to the *Journal of the Society of Arts*, in which my paper was published, a copy of which I enclose. The process suggested by "Eisenstein" was once used in Scotland, and the resulting iron was called "tiger iron." If metal run into water direct from the blast furnace, when crushed and melted, will produce cast-steel, I grant your correspondent every point he asks for. It is not possible by any such means to produce cast-steel. I shall be very happy, to the fullest extent in my power, to satisfy any one engaged in the difficult question of what will, and what mixture of metals or iron ore will not, produce a merchantable cast-steel, if they will address me direct upon the subject. C. Sanderson.

St. James's-street, Sheffield, May 18.

COPY OF NOTE SENT TO THE "SOCIETY OF ARTS JOURNAL."

Sir,—In reading my paper, perhaps some misapprehension may arise as respects the reduction of the metalloids and the discharge of the phosphoric acid. The *rationale* is this:—Sulphate of iron being used as a flux, the oxygen of the sulphuric acid, and probably that of the protoxide of iron also, or a part of it, unites with the carbon in the pig-iron and the metalloids, oxidising the latter into their earths; the sulphur into sulphurous acid; the carbon becomes carbonic oxide, or carbonic acid, most probably both; the sulphurous acid goes off in fumes; the earths due to the oxidised metalloids pass, with the phosphoric acid, into the cinder. The phosphoric acid has by accident been described as volatile, which it is not—at least, it may read so in the paper. C. Sanderson.

ECONOMISING THE WASTE GASES OF BLAST FURNACES.

There has been a vast number of propositions for utilising the gases which are continually being thrown off from blast furnaces, but, owing to the action of the furnace being in nearly every instance impaired by their use, they have never been generally adopted. This fact renders Mr. Parry's paper "On the Principal Causes of Derangement in the Working of Blast Furnaces where the Waste Gases are Economised," read before the South Wales Institute of Engineers,* of great importance, as it is calculated to lead to the removal of the difficulties, even if Mr. Parry's suggestions be proved inefficient. When the gases are collected after they have really left the furnace, and not before, no derangement whatever takes place in its working. To effect this, they must be taken from a chamber constructed above the surface of the minerals; for, if taken from any practicable point of the furnace below that surface injury to a greater or less extent follows, owing to the ascending current of heated deoxidising gases becoming diverted from their usual regular course, which should be at equal velocities over the whole sectional area of the furnace at any given height. Thus, if the gases are taken through lateral apertures in the walls, the minerals there will become more highly heated and chemically acted upon than those in the centre; and if taken from the centre of the furnace, by sinking a pipe in the middle to some depth below the surface, the middle portion would become hotter than the sides, both entailing an injurious effect on the quality of the iron and economy of fuel.

The first method adopted for collecting the gases was the same as that used on the Continent. An iron tube was sunk into the furnace 7 ft. deep, and about 3 ft. less in diameter than the throat, thus leaving an annular space 1½ ft. wide between the walls and the iron tube. From this chamber the gases were allowed to pass off by the pressure within the furnace, through a pipe which penetrated the walls. When the tube was kept full of mineral, about one-third or one-fourth only of the gas escaped into the open air, the rest passing into the annular chamber. The result of this system was scaffolding, with the usual accompaniments of black cinder and inferior iron; for when the tube was kept full of minerals the contents acted as a loose stopper to the current of hot gases forced upward by the pressure from beneath, and diverted them towards the annular space, where there was no such resistance, thus leaving the minerals in the central parts of the furnace insufficiently supplied with the upward current, and consequently with caloric. When the tube was kept only partially filled the furnace worked better, and produced a superior iron, but less gas was economised. The old conical narrow topped furnaces were affected much less than the improved dome-topped of large capacity, where the attempt to take off a large proportion of the gas, by sinking a narrow iron tube into the throat proved a failure, and a wider one had to be substituted. It appears certain, then, that no system of drawing off the gases from the sides could be adopted without injuring the action of the furnace, and that the only unobjectionable method would be to collect them in a chamber above the surface, thus equalising the pressure over the whole area of the mouth, and thereby allowing an equally free flow from the ascending current up the middle as well as up the sides; in fact, restoring the furnace to its original state as far as the direction of the flow of heated gases upwards would not be interfered with by any unequal resistance; and, besides, the whole instead of a portion of the gases would become utilised.

From careful observation and experiments, it has been found that the covering of the top has no effect on the action of a blast-furnace kept full to the mouth, and which has the proper form and proportions from thence downward. The mouth must be understood to be that part which represents the mean height of the surface of the minerals, and not

* The first number of the *Proceedings* of this body may be had at the *Mining Journal* office. Price, 2*s.* 6*d.*

the top of the brickwork; and the question arises, what proportion should that bear to the widest part, and what the latter should be with reference to the height, to secure a maximum economic effect in the quality of iron made and the yield of fuel? This state of perfection can exist only when the isothermal lines in the furnace are parallel to the horizon, the temperature of the minerals being the same through the whole horizontal sectional area at that height, and, consequently, arriving at the zone of fusion in an equally prepared state.

Coming to the question of what form and proportions a blast-furnace should have to produce the best results in quality of iron and economy of fuel, whether worked with open top, or covered over, for the purpose of saving the gases, experience has proved that when the mouth is one-half the diameter of the widest part, good work is obtained, and that any deviation either way, if in excess, has been productive of serious derangements in its action. It appears also that the height of a furnace should bear a certain proportion to the greatest diameter, in order to secure a uniform flow of the ascending current through all its parts; for if the width bear too great a proportion to the height, the boshes must necessarily be of a low angle, and, consequently, the minerals around the sides near their top be too great a distance out of the direct line of passage of the ascending current to be perfectly acted upon by it. Mr. Parry then enters fully into the conclusions which he has arrived at as to the dimensions, &c., of blast-furnaces calculated to produce the best results, and gives several diagrams, which materially assist in rendering his explanations easily understood.

COAL MINING IN SOUTH STAFFORDSHIRE.

LECTURE BY THE GOVERNMENT INSPECTOR.

The "Association of Working Miners," at Dudley, a short time ago, invited Mr. Lionel Brough, the Government Inspector of Coal Mines, to deliver them a lecture on some subject connected with Mining, to which Mr. Brough at once acceded. The lecture was delivered on Monday evening, the 10th inst., at the Lancashire School-room, Dudley. Some hundred working miners were present, and a number of other persons, including several proprietors of mines in the neighbourhood.

Mr. S. H. Blackwell presided, and addressed a few very appropriate remarks to the meeting, on introducing the lecturer, on the growing desire for a greater unity amongst all classes, and on the importance of working men cultivating habits of thoughtful observation, in order to enable them more successfully and more safely to discharge their duties, holding up the example of George Stephenson as an encouragement to all who possessed ability, and had the perseverance to apply it.

Mr. Brough, who was very heartily applauded on rising, then delivered his lecture, which was in matter and mode alike deserving of high praise. It is impossible to do more than to give a *resumé* of the lecture; but our regret at this is lessened by the fact that it is shortly to be published. We shall in our extracts confine ourselves to those portions which refer to the mines and mining operations of Staffordshire and Worcestershire. Speaking of the peculiar features presented by the coal formations of this district, Mr. Brough observed that in South Staffordshire and Worcestershire there is a total absence of certain deposits which are characteristic of most other coal fields. Here the coal, ironstone, and all conconnectant strata repose on the beds of the upper silurian; a vast formation which has been developed, and most beautifully described by Sir Roderick Murchison. You all know some of these beds: they consist of limestones and bavin, lying under all our coalfields, but most conspicuously showing themselves at Sedgley, at the Castle and Wren's Nest Hills, and at Walsall. Our measures were deposited directly upon these more ancient beds, entirely without the interposition of the thick masses called millstone grit, mountain limestone, and old red sandstone. In North and South Wales, in Derbyshire and Yorkshire, in Durham and Northumberland, those intervening formations are always found. Here in our own immediate neighbourhood they do not exist at all. Nevertheless the smelters here lost nothing by their absence, for the upper silurian limestones are quite equal as a flux in the blast furnace to those of Pontypool, Merthyr, or indeed of any other iron-making district whatever. But another phenomenon, important in its results upon mining operations, was the protrusion of basalt, or rag as it is locally called, which had raised the whole beds of coal, rendering them more accessible, but which also had produced a remarkable disturbance and division of those formations. But, said Mr. Brough, I believe that no district is more cut up, divided, subdivided, and shattered than the one in which we are now assembled. From Cannock Chase to Stourbridge, from Wolverhampton to Walsall, it is rare to get a couple of hundred yards of straight gate roading. Thus, then, to the volcanic struggles of that remote period we may reasonably attribute many of the mining difficulties, and some of the fatal accidents which unfortunately in our day are of too frequent occurrence. After taking a historical glance at the progress of mining in the district and in the country generally, Mr. Brough proceeded to point out the different methods of getting coal, urging that, in sinking, large and roomy shafts were essential, and as ventilation was all-important, narrow roads and air-ways should always be avoided; they should invariably be wide and high. The first thought should be for the health and safety of the working men; all other points were secondary; though all should be carefully considered by the mining directors. In order to ensure perfect ventilation, a well-constructed and powerful furnace near the bottom of the upcast-shaft was a very important and necessary adjunct. Guide rods, or conductors, should be resorted to when available, and cages and catches should supplant the primitive wagons so generally used in the district, and equally dangerous and injurious to thorough ventilation. True economy in mining was generally favourable to the safety of the miner; but there was a false economy in mining operations which ever proved destructive to human life, and was eventually detrimental to the employer's interests. The thick coal of the district was the noblest seam in Europe, and usually worked by square-work. There were many excellent collieries conducted on this system; but with every care and prudence it was found practically to tend to serious loss of life and waste of mineral produce; whilst by adopting long work, and extracting the coal in two sections, as adopted in the collieries belonging to Mr. Foster and Mr. Gibbons, at Shutt End, the work was conducted with far greater safety to life. On this point Mr. Brough remarked. We must now see in what manner this mode of getting the thick coal and the new mine and fine clay coals affects the safety of the workmen. In order to do this, we find that in the years 1855, 1856, and 1857, there were killed by falls of coal and roof in the districts of South Staffordshire and Worcestershire 268 persons; by far the major portion of whom lost their lives in pillar and stall, or square workings. But to afford a more complete view of this terrible mortality, I will take one single year, because I really have not had time to search the returns of them all as far as particular modes of death are concerned. In this single year it was found that 74 deaths had occurred from falls in the thick coal and the new mine and pure clay coals, both worked by pillar and stall, whilst only seven deaths took place in the other mines of the district where the long wall system of getting thin coal is exclusively practised. Now, in extending this comparative view of coal-mining accidents, it is found that for every 2,000,000 tons of coal and slack gotten in Great Britain only ten persons are killed by falls of roof and coals, whilst in this district, where we now are, twenty-seven are lost to get the same quantity of materials. With such calamitous results, I believe no party whatever, be he master or man, will attribute officiousness to me for having warmly recommended that mode of getting coals by which the minimum number of persons may lose their lives in pursuing their daily avocations. This now brings me to another statement connected with the statistics of death in coal mines. I have been in this district just two years and a half, and during all that time the very extensive collieries belonging to Messrs. W. O. Foster and R. Gibbons have been carried on with the greatest activity in the thick coal without the loss of a single person. No writing or lecturing can give expression to these extraordinary and happy results; to think that in other mines in the same district hundreds of persons have been killed in the short space of three years, while at the two great Shutt End Collieries, which turn out very large quantities of coal, no life whatever has been sacrificed in the thick measures, in the some period of time. I repeat that no lecture or lectures can do justice to such an extraordinary and gratifying fact as this. But whilst this method involved a great saving of human life, it was really most economical, as it was proved that 10,000 tons per acre more coal could he got in a ten-yard seam by this than by the other method. In conclusion, Mr. Brough urged upon the workmen the necessity of self-culture, and the promotion of education in young and old; showing that education instilled thoughtful habits, and thinking men were ever to be trusted in the pits. Thinking men were also invariably rising men, providing they also adhered to temperate habits, and such habits underground were of vital importance both to workmen and masters.

At the conclusion of the lecture, which was listened to with great attention, a working miner briefly proposed a vote of thanks to the very able and talented lecturer.

Mr. Frederick Smith seconded the proposition in a forcible and feeling speech, and the vote was carried by acclamation.

In proposing a vote of thanks to the Chairman, Mr. A. B. Cochrane expressed the great pleasure he had felt in meeting the working men of the district, and deeply regretted that so few of his own men were present to benefit by the admirable address delivered by Mr. Brough. Mr. Cochrane suggested that, with Mr. Brough's permission, the lecture should be printed at the expense of the masters, and freely distributed among the workmen. This proposition was seconded by Mr. Cook, and heartily carried,

TAXES UPON MINERAL INDUSTRY.—The London Corporation Coal Tax is again occupying the attention of the trade, the Corporation Reform Bill being now under consideration presenting a favourable opportunity for agitation. It is proposed to appeal to Parliament to include in the bill provisions for the extinction of the obnoxious impost. The tax consists of three distinct duties of 8d., 4d., and 1d. per ton, which were originated for purposes long since satisfied, but they have been from time to time renewed by various Acts and for new purposes; and, as the Corporation Bill, which will be considered as a final measure, makes no mention of them, it is evidently the intention of the City authorities permanently to continue the tax if permitted. The duty of 4d. per chaldron was, with other taxes, granted to the Corporation in the time of William and Mary, to enable the Court of Aldermen to pay its debts, amongst which was one of about 750,000*l.*, mainly the property of the children of freemen who had died intestate, and the amount had been dealt with as a loan to Charles II., or in some way by which it became entirely lost. These debts, principal and interest, have been discharged years ago, yet the duty is continued to the present day; and in 1862 reverts to its original amount of 4d. per chaldron, from which it was changed to a tonnage in 1831, to meet compensation to the meters of seaborne coal, whose office Parliament in that year abolished. It now amounts to about 70,000*l.* The duty of 8d. per ton, which now yields about 140,000*l.* per annum, is handed over to the Government Board of Works, and has been applied to improvements within the City of London—such as London Bridge, the Post Office, Farringdon Market, the Royal Exchange, &c., and to improvements beyond the limits of the City—such as New Oxford-street, Cranbourne-street, Victoria-street, Westminster, &c. The balance of the charges upon it in 1853 was 1,042,000*l.*, for the payment of which it is mortgaged until July 5, 1862, when the Act under which the duty is levied will expire. The duty of 1d. was created for raising a fund for establishing a coal market, renewed under William IV. for other purposes; and again by an Act of the 8th and 9th of her present Majesty for public improvements in the metropolis. Not only those connected with the coal trade, but also manufacturers, have cause for complaint, as they are made to contribute very largely to the corporation, the public improvements being carried out so much at their expense from the quantity of coal they consume, whilst it could be done at the expense of all classes in the community by an improvement rate. It is hoped that the present opportunity will be taken to declare that the 8d. duty shall not be again renewed, and that the 4d. duty, which is only now a portion of the ordinary Corporation revenue, and the 1d. duty, which is expended at will by the Government Board of Works, without the constitutional supervision of the House of Commons, shall cease at once. These duties fall very heavy upon the consumer, and as they must in a measure limit the consumption, having a prejudicial effect upon the producer, no time should, therefore, be lost in taking the necessary steps for securing their abolition.

Original Correspondence.

COLLIERY OPERATIONS—"BORING."

TO THE EDITOR OF THE MINING JOURNAL.

SIR,—In reply to your correspondent "M.E." I send you tables of borings actually executed, which I obtained from Mr. Kind. He has requested me to make arrangements for the introduction of this system of boring into England, and I shall be happy to supply any further information which may be desired by persons wishing to apply it. Reference to geological maps will show that a large portion of the apparent limits of our English coal fields are covered by new red sandstone and other rocks, by boring through which discoveries may be made tending greatly to extend the ascertained area of the coal-bearing rocks. Such discoveries are especially important in the neighbourhood of large deposits of iron ore and of populous towns. Landowners in or near coal fields may have the value of their property greatly increased by the results of a deep boring. In many instances the previous boring of a hole 12 inches or more in diameter will greatly facilitate the sinking of a shaft, from the timely information it will afford as to the water to be expected, and other difficulties in the tedious operation of sinking. The cost can be counted beforehand.

Clifton Wood House, Bristol. HERBERT MACKWORTH.

TABLE No. 1.—ABSTRACT OF REGISTERS OF BORINGS ON KIND'S SYSTEM.

Localities.	Diam. of bore.	Depth in yards.	Time in days of 12 hours.	Cost of labour and material per yard.	Cost of the boring.	Nature of the rocks.	Observations.
	ft. in.			£ s. d.	£ s. d.		
At Monorot, Jura. No. 1	0 12	164	84	0 19 8	160 10 0	Shifting sand and gravel, 32 yds.; lias marls, 43 yards; gypsums, 66 yards; sulfierous, 22 yards.	Without cost of installation and carriage of tools, &c.
ditto No. 2	0 12	185	112	1 2 0	209 12 0	Ditto	
ditto No. 3	0 12	309	In progress				
At Stirling, Moselle. No. 1	0 12	327	354	0 19 1	311 11 0	New red sandstone, 68 yds.; carboniferous, grits, and shales, 131 yds.; coal measures, 109 yds.	Employing a small engine and attendant.
ditto No. 2	0 12	355	422	1 0 11	372 5 0	Ditto	
ditto No. 3	0 12	295	330	0 19 8	289 11 0	Ditto	
ditto No. 4	0 12	120	216	1 4 4	140 0 0	Ditto	
At Grimes, Pas de Calais	0 12	203	86	1 1 9	285 17 0	White chalk, 100 yds.; hard grey chalk, 103 yds.	
ditto	0 12	159	37	1 0 7	164 0 0		Without cost of installation, but including tubing.
ditto	0 12	371	37 mon.	5 1 0	1673 0 0	Chalk, 46 yds.; white grit, 14 yds.; keuper chalk & gypsum, 86 yds.	
At Vizernes, Pas de Calais	0 10	382	14 mon.	2 2 0	829 0 0	Gypsum, 35 yds.; red marls, 87 yds.; quartz, grit, and red sandstone, 259 yds.	
Boring 764 yards deep:—							
At Mornhoff, Grand Duchy of Luxembourg. By old system	0 10						
By new system	0 10						Boring a "core."

TABLE No. 2.

ABSTRACT OF REGISTER AT KREUTSBERG, NEAR FORBACH (MOSELLE).—Diameter of hole 11·8 in.

Date.	No. of days of 12 hours.	Depth bored.	Mean depth bored per 12 hours.	Total depth of the boring.	Nature of ground.	Remarks.
1852.		Yards.	Yards.	Yards.		
May 1—May 11	3	7·63	1·07	10·83	New red sandstone.	
June 1—June 4	4	9·20	1·75	20·03	ditto	
" 14— " 17	24	43·14	1·75	52·97	ditto	
" 20— " 20	6	13·53	2·26	66·50	ditto	Using the free-falling instrument.
" 21— " 29	17	38·40	2·26	104·90	ditto	
" 29—July 26	50	63·79	1·27	168·69	ditto	
July 26—Aug. 11	29	30·65	1·06	199·34	ditto	
Aug. 11— " 12	3	3·25	...	202·59	ditto	
" 12— " 19	13	4	0·34	206·95	Hard blue sandstone.	The instrument not acting well.
" 19— " 21	21	...	...	206·95	Red sandstone	Boring with diamond tool.
Sept. 6— " 11	81	10·63	...	216·68	Alternating with shale.	
" 11— " 17	12	2·66	...	219·25	ditto	Cleaning out the hole.
" 17-Oct. 5	22	0·33	...	219·58	ditto	Two pieces of the chisel left at bottom of hole, and afterwards dive pieces.
— " 5	1	...	...	...	ditto	In consequence of not succeeding in raising these pieces, determined to bore forward.
Oct. 5— " 20	15	7	0·47	226·12	ditto	A storm overturned and destroyed the bore-house and sheds
" 20— " 23	3	1·54	0·51	227·66	ditto	Re-erecting bore-house, &c.; doing repairs.
" 23-Nov. 2	10	7·54	0·75	235·20	ditto	With diamond tool.
Nov. 2— " 16	25	14·38	0·57	249·58	Limestone, with red [clay.	
" 16— " 28	23	10·49	0·45	260·07	Grey shale.	
" 28—Dec. 8	20	10·49	0·52	270·56	Coal shale.	
Dec. 8— " 25	34	21·72	0·64	292·28	Sandstone.	
" 29— " 31	11	3·13	0·29	295·90	Sandstone.	
1853.						
Jan. 1—Jan. 2	2	1·93	0·48	297·80	Shale.	
" 2— " 9	9	6·01	0·42	303·90	Sandstone.	
Feb. 9—Feb. 28	14	29·86	0·34	333·76	Shale.	
Mar. 1— " 1	87	0·55	0·34	334·31	Coal.	
	1	0·46	0·46	334·77	Shale.	

TABLE No. 3.—KREUTSBERG, NEAR FORBACH (MOSELLE).

Table of Monthly Cost of Boring.

Month.	Depth bored.	Disbursements. Total.	Plant.	Labour.	Division of labour expenses. Borers.	Smiths.	Carpenters.	Sundries.	Entire cost per yard each month. (See below.)	Entire cost per yard for each 100 yards.
1852.	Yards.	£	£	£	£	£	£	£	Shill.	Shillings.
May	7·63	124·18	98·64	25·53	2·03	..	8·19	15·21	..	....
June....	8·99	193·77	134·03	59·74	47·85	3·38	3·18	5·31	25·99	25·99
July	71·75	114·38	47·40	66·98	51·31	4·14	0·28	11·25	28·77	2d 100 yards,
August..	35·77	109·02	50·56	58·46	49·02	3·88	2·12	3·44	43·39	at per yard,
Sept. ..	5·22	55·98	..	55·98	45·77	3·14	0·11	6·16	232·54	43·50
Oct.	6·69	61·36	12·52	48·84	31·74	2·3	5·54	9·25	161·25	3d 100 yards,
Nov.....	38·27	65·24	3·38	61·86	51·58	3·7	..	6·53	43·70	at per yard,
Dec.....	32·65	82·73	7·85	74·87	65·20	3·75	0·19	5·74	57·03	59·15
	296·97	806·65	354·38	452·26	344·50	25·13	19·61	62·91	41·06	

OUR AUSTRALIAN COLONIES—THEIR RESOURCES AND IMPROVEMENTS.

GOLD FIELDS.—The news from the gold fields, although not very encouraging this month, is not quite so depressing as last, for several new finds have been made in the northern and southern district of New South Wales. Those in the northern are confined, or rather have been made, in the neighbourhood of Tenterfield, Rocky River, where we stated in our last communication that a new gold field of considerable extent had been discovered. In the same part of the country, at a place called Glen Elgin, things are also improving, and the last accounts from there state that the miners were making from 10*s.* to 1*l.* per day easily, and in the same vicinity a miner washed 7 ozs. out of one tin dish, and the claim on being further worked showed little appearance of falling off, and the lucky owner was looking forward to the possession of a handsome fortune in a very short time. This is, no doubt, an exaggeration, and that the 7 ozs. were most likely pennyweights, but even in that case the claim cannot fail to be highly remunerative to the possessor. In the same district a party of Americans have been to a considerable expense in diverting a stream of water, for the purpose of working the bed of the water channel, out of which they anticipate large returns. The Bathurst, or western district, is particularly dull this month, and with the exception of one or two finds, about which there are conflicting reports, the intelligence seems to imply that unless something fresh turns up very shortly the whole region is likely to prove a *shicer*. The southern diggings, or those in the southern district, are, on the other hand, looking up, and the last accounts from Braidwood are flattering, for the number of miners has not only increased, but also the last escort brought to Sydney 1200 ozs. of gold. Even that is no criterion to go by in order to judge of individual success, for the larger proportion of the fortnightly returns from the diggings generally belongs to the companies, who are all, with scarcely an exception, doing well in the southern districts, and the last new rush to the Shoalhaven Flats is likely to produce "many a change in the affairs of man," which if judiciously acted upon may lead to fortune, and many an anxious eye is turned to the skies on a morning with the hope of discovering indications of rain, which is to consummate their golden expectations. A new rush has also taken place to Bungonia, in the vicinity of Goulbourn, where rough gold has been found on the edges of the slate in the creeks, but hitherto not in sufficient quantities to be remunerative, although it is anticipated that with the next rains matters will improve. This, however, is merely a surmise, and like many more of a like character will probably prove unfounded, so that there will be no alternative but to wait for an improved plan of working. The news from the Munya is quite flat, and the people thereabouts think they might as well try at their own doors as any where else, for the gold is more or less distributed throughout the entire region, but is seldom found in sufficient quantity to pay for the labour necessary to obtain it. Tuena and Adelong, near the borders of Victoria, are also looking up, and some Celestials who were making their away from Victoria were intercepted on the road, and a large amount of gold converted into rings and other ornaments were seized under the plea of being contraband goods. The news from Victoria is exceedingly dull, and there seems a general depression throughout the colony, and it would seem from the accounts that there is something serious looming in the distance; and rumour has it that the Melbourne merchants are already trembling at the anticipated result. The Government of Tasmania has offered 5000*l.* for the discovery of a paying gold field, but hitherto (notwithstanding the number of claimants for the prize, each of whom claims having found a gold field that fully entitles him to the reward offered) the award has not been made. Indeed, if one-half the paying gold fields said to be known to the numerous applicants for the 5000*l.* be in Tasmania, surely every part of the island should be fabulously rich in auriferous deposits. A new gold field is also said to have been discovered in the district of Otago, New Zealand, and within a distance of 14 miles of the harbour of Invercargill. The discoverer was first led to it by the glittering appearance of the mica that was intermixed with quartz pebbles and ironsand in the bed of a running stream. It is a remarkable fact that gold has been found in greater abundance in drifts containing ironsand than in any other, and it is, therefore, probable that in the end this may lead to the discovery of a paying auriferous district. The gold field in the neighbourhood of Auckland, and known as the Coromandel, is more of a quartz reef than otherwise, so that before much can be done quartz-crushing and other machinery will be necessary. The news from Nelson contains a budget of accidents resulting from destructive floods, which have swept away everything belonging to the miners, and but for this it is said that the gold field in that district would have been ere this in a fair way of realising the hopes long entertained of it. But this does not coincide with other accounts, that represent a number of miners, who went there from the colonies of Australia for the purpose of gold digging, walking about without anything to do, and that, in fact, many of the gold fields said to have been discovered there have proved to be *shicers*. Some years ago, when in England, we were shown a paper containing a sample of auriferous ground, which had been brought from the vicinity of New Plymouth, New Zealand, and which was composed of a little gold mixed with mica, ironsand, and emery, and we now feel convinced that if that district were properly examined a good paying gold field would be the result.

COAL TRADE, &c.—The coal trade has been rather dull during the month, but as the winter sets in a brisk demand is expected. It is also reported that the new manager of the Australian and European Mail Company (Mr. Wetton) contemplates using colonial coal on board of the mail steamers in future, and several cargoes have been already delivered at the company's wharf, some from Newcastle in the northern, and some from Wallecgereg in the southern coal district of New South Wales, and the result of the first trial is to decide which of the two districts is to have the preference of supplying the company with coals. Newcastle, the great coal mart of New South Wales, has been rather busy during the year 1857, for according to the returns of the Customs 393 vessels cleared the port last year, 387 of which were British, with a total tonnage of 68,487 tons. This is a large amount of tonnage for that small place, and clearly shows the increase in the coal trade of the colonies. On the strength of this the Newcastle people can certainly, with some show of probability, look forward to a prosperous future, and all they say that now is required to impel them onward in the march of progress is a steam-tug, by which to surmount the difficulties of the harbour, the entrance to which is very dangerous, especially during boisterous weather. The people of Newcastle, however, belong chiefly to the old *regime*, and are utterly at a loss to comprehend the elements involved in a progressive age, and hence they are constantly harping the Government on the one string—steam-tug; not thinking that, by the time they get it, it will be, or should be, superseded by a line of auxiliary screw coasters, for which the coasting trade of Australia is so singularly adapted. Coal, it is said, has been lately discovered in the Bothwick Ranges, South Australia, extending from Nuyts Archipeligo to Mount Hope, and at a distance of about six miles from the coast. It is supposed to resemble in quality the coal of New South Wales, a kind of anthracite, and suitable for steam purposes. It is, however, to be feared that this, like many other discoveries said to be made in different parts of the colony, will, on being examined, prove of little value, although, geologically considered, the coal in that direction, other conditions being equal, should be stronger and more compact than that of New South Wales. It seems very strange that the Government geologists of Victoria cannot find coal in that colony, for it is there in great abundance, and during an examination of a section of country in that division of Australia, we came upon two places in which strong indications of coal presented themselves. The cause of this failure evidently arises from taking the text books of European geologists as their guide in searching for it, which are not of any service in that respect here, for they instruct students to consider that the strata have been deposited, disturbed, and thrown into different planes, whereas that is the exception and not the rule here (that is Salzsonto), logically considered.

HARBOURS AND RAILWAYS.—Surveyors are now engaged in making a survey of the harbour of Kiama, for the purpose of improving it. Kiama is about 60 miles to the south of Port Jackson, in the centre of the Illawarra district, the garden of New South Wales, and is the great resort of the *elite* of Sydney during the summer months, in a word, the fashionable watering place of New South Wales. It is, with the exception of a narrow inlet of the sea not capable of containing more than three vessels of small tonnage at the same time, utterly devoid of the natural advantages of a harbour, so that the cost of rendering it available for any amount of shipping will be considerable, and more, it is to be feared, than the Government will be in a position to appropriate for the purpose at the present time. However, if any appropriations be made, the Illawarra district should have the preference, particularly before the Hunter district, for in the former case little if any improvements have been made by the Government, whereas in the latter a large proportion of the money voted for harbour improvements in the colony has been expended in the improvement of the harbours of Newcastle and the dredging of the Hunter River; and, after all, the harbour is little if any better than at first, and the Hunter is much more difficult to navigate than ever. The extension of the terminus of the Great Southern Railway to the Steam Packet Wharf, Newcastle, Hunter River, has been completed, and the new station buildings are progressing rapidly, so that it is expected that this small addition to the great trunk line will be opened early in April next. The Pyrmount Bridge, a wooden structure extending across Darling Harbour so as to connect Pyrmount, and not Balmain as stated in a former letter, with Sydney, is temporarily completed.

PATENT LAWS.—It seems very singular that the Government of New South Wales, who are utterly at a loss to devise means to replenish a treasury that is being constantly drained by the numerous demands of public works and improvements, should not hit upon one of the many expedients open to them, by altering some of the restructive laws on talent and industry, which, though of no paramount importance when considered singly, yet, when taken collectively, are of the utmost consequence, not only in a financial point of view, but also as bearing directly and indirectly on the development of the resources of the colony. Let any one who might be disposed to question these views examine the statistical reports of the American Government, in which they will find that the amount annually received for patent rights forms a large item in the general revenue of that country. But why? Because the securing of a patent right is so arranged as to be within the power of persons of limited means, and therefore those who have talent and genius for invention turn their attention to some improvement for which they secure a patent; and notwithstanding that not more than five per cent. of the number of patents taken out prove of any ultimate importance, still the revenue is increased, and the result is a gradual improvement in every branch of business, for those who do succeed more than compensate for the losses sustained by others, by opening out new and very often lucrative employment for the million. The number of American patent inventions imported here ought, without any other notice, to convince the Government and the people of New South Wales of the necessity there exists for an alteration in the patent laws. Nearly all the farming implements are of American manufacture, and the amount of American manufactured goods of every description brought into the colonies is very considerable, and yet those who legislate, and even the people themselves, cannot perceive that the cause of their being able to import goods into the colonial market at a profit arises from the encouragement given to talent and industry, but more particularly native or citizen talent and industry; for the Americans are cute enough to know that a genius will often give force to ideas which, if acted upon, result in opening out profitable employment to thousands, and also ensures to them the advantages that attend the first step made in the practical introduction of valuable improvements in the manufacture of goods or implements of any kind (for example, Morse and Colt), by enabling them to compete successfully with older and more matured countries.

AMERICAN ROPE-UNTWISTING MACHINE.—Mr. Henry, the patent agent, 84, Fleet-street, has recently specified, in this country, on behalf of an American inventor, an ingenious machine for unmaking rope, or effecting the separation of the strands, which is the first stage of its reduction to its original fibre. The apparatus consists of a revolving roller-head, carrying two feed-rollers, having their axes perpendicular to, and on opposite sides of, the axis of the head, and combined with a pointed mandril placed in line with such axis. The rope being conducted between the feed-rollers through the hollow shaft of the head, is continuously driven on the pointed end of the mandril; and receiving from the revolution of the head rotary motion in a contrary direction to the "lay," the stands are easily and effectually parted. The feed-rollers are suitably adjusted and kept to their work, and may be formed with teeth to gain a better hold on the rope.

CORNISH MINE PHOTOGRAPHS—No. XXX.

"THE DROP IN THE CUP."

How often do great results accrue from small beginnings. The fall of an apple led to Newton's grand discovery of the most subtle and powerful of Nature's laws. Unpromising as the title of our paper may appear, yet as we profess to be merely the narrator of facts connected with mining matters and mining people, we, as in duty bound, record such as we deem will be interesting and instructive. Our papers, we have the satisfaction of knowing, are read by the younger portion of society. Should but one be led to reflect and act upon the moral of our tale, our end will be served, our trouble cancelled. We proceed to our tale, which a poet might richly adorn, a divine improve. But it becomes us only to hold the mirror up to Nature, to depict things as we find them, leaving the garnishing to abler pens.

We are aware that instances of a similar character are not wanting to illustrate extraordinary facts connected with human progress. As in this instance, they are always founded on some of the simple laws of nature. The sublime teachings of the Great Architect only require attention to render them profitable to him for whom they were intended to be enjoyed. Man is placed in a region of magnificient profusion, if he knew but the true value of the privileges by which he is surrounded. He is the realisation of the eastern fable of Aladdin, and withal has the "little lamp," which only requires a little rubbing to discover the true value of its hidden worth. We particularly commend our remarks to youth, in the sincere hope they may profit by our "o'er true tale."

In the United Mines, Gwennap, some of the deepest and most dangerous of the Cornish mines, there are (as we have said in one of our previous papers) "Bal Boys" employed. We, in that article, dwelt largely on their sufferings, and invoked (not in vain) sympathy with their woes. We were long aware of their ingenuity, and could have mentioned the improvement of self-acting gear, introduced into steam-engines for lifting arbors and opening valves, to save the trouble of doing so by hand, as an instance, but then we were not pourtraying their natural capabilities but their wrongs. At these extensive works, in the 100 fm. level (with the adit 636 feet from surface) is a place at which a capstan or windlass is worked, necessitating for their erection and working an extensive excavation. From this point as a centre diverge levels to the different parts of the mines. Here, where the men are not at work, with the ponderous machinery, all is gloom and silence, save the footfall of an occasionally passing miner with his dim candle. In one of these galleries, or levels, termed a cross-cut, and out of the usual route of even these few miners, were employed two boys, the elder ten years and the younger no more than seven years of age, to work an air-machine. Only one was in this spot at a time. Their duty here was to turn a handle, precisely like that of a grindstone, which rotated a fan with amazing rapidity, to convey air to the miners through a tube to the backs, or places where they raise the ore, in bad air. The slightest neglect or cessation from toil on the part of these poor lads would be immediately detected by the miners as a matter of course, and chastisement severe enough consequently follow. The monotony of this unbroken, continuous round in such a prison house, besides the labour entailed by continually exerting the muscles of the back and arms, may be conceived but cannot be described. No wonder, then, that these lads looked forward to the period of time for their ascent to sun and air. Boys will be boys—marbles and tops have their attractions. Many a weary hour did they pine their lives away, in hope and anxious desire. Solitary confinement and hard labour for eight hours are deemed punishment for criminals; what was this?

At length one of them desired to have a watch, that he might count the hours, and know when they passed. But, vain hope! how was he out of 2s. per week to gain one? Necessity is the mother of invention. He, by the light of his candle, watched a drop of water falling from the roof at long but regular intervals. The idea struck him that if they were regular they might be made to indicate time. Procuring an old tin cup he had found in one of the levels, he placed it under the falling drop, and found that it always dropped into the cup. Here was a point gained. He borrowed a watch, by which he found it filled in a certain space of time. To regulate it so as to suit his purpose, he reduced the size of the cup, so as to fill it within the hour, and his experiment succeeded to his entire satisfaction and comparative happiness. "I felt the hours pass," said he, "and listened to the 'drop in the cup' as a companion and friend. I never afterwards felt that absolute isolation, that perfect oblivion, I had previously done. Besides, it taught me to think, to reason on natural laws, to pay strict attention to little things, with a view to their application to greater ends. From that time forth I began to study. I went to evening and Sunday schools; endeavoured to raise myself by study and care. I soon went underground, and worked as a tributer. My now settled habit of attention to little things stands me in good stead in this era of my life. I have been successful in an eminent degree. Soon afterwards I was created an agent. Here, too, I found the same habits had the same effects. I owe my success and present position in life mainly to this little incident in my boyhood. My solace and comfort made such an indelible impression on my mind that it will never be erased."

This bal boy is now one of the most eminent of Cornish captains, and has under his charge property to the value of hundreds of thousands of pounds. We gathered these particulars from his own lips. Though in the sear and yellow leaf, he still speaks of the occurrence with delight. It was as great an era in his life as the apple in that of Newton, and affords, we think, an excellent example of the fruits of attentive observation by boys of little things as leading to great results; for little did the poor untutored lad dream, whilst working in the United Mines, that he would become the manager of some five times as large, through having watched the "Drop in the Cup."—GEORGE HENWOOD.

OFFICIAL CORRESPONDENCE WITH CAPT. NORTON.

"*Office of Ordnance, March* 8, 1832.—Having by the Master-General's command referred your letter of the 18th ult. to the Select Committee at Woolwich for their observations, I am directed to acquaint you that the committee have reported in reply, that on an attentive perusal of your remarks (1) they are convinced of their fallacy, and they do not, therefore, recommend that you should be furnished with the rifled gun for any further experiment, which offers no promise of advantage to His Majesty's service; the Master-General regrets, therefore, that he can take no further steps on the subject of your invention (2).—G. COWPER."

Extraits du *Journal des Sciences Militaires, Oct.*, 1833:—"Ce serait une découverte bien importante dans l'art de la guerre, que celle d'une méthode infaillible et non dangereuse, de faire éclater les projectiles creux à l'instant de leur choc contre le but. Malgré tout ce qui à été proposé par les auteurs (3), et tout ce qui à été avancé par les feuilles publiques, cette invention est encore à faire, elle aura probablement les corps fulminons pour base."

Extract of a letter from Capt. Stevens, of the Royal Marine Artillery, to Capt. Norton:—"*Portsmouth, July* 15, 1835: I made several experiments at the greatest distance I could command for accurate experiment with your rifle cannon (one-pounder), which was 450 yards; at that range I can have no doubt but the spiral direction imparted to was preserved by the projectile. One shell (4) grazed short on the ground 100 yards and did not explode then, but after grazing the shell lodged in the butt and instantly burst."

Copy of a letter from Capt. Hector Straith, of the East India Company's Military Seminary, Addiscombe, to Capt. Norton:—"*Addiscombe, Nov.* 2, 1835: I think I can say, in the name of all the numerous spectators of the East India Company's Military Seminary at your three experiments this day, that we were all much gratified, and perfectly convinced of their applicability. Indeed, no demonstration could be more convincing of the complete success of your rifle shells (5) than the ocular one of the box of powder, on the present and on the former occasion, when the thickness of the side of the box pierced was 1 in. of elm, the same, I believe, as the artillery limber boxes; and if I were an artillery officer, I should be very nervous if I knew the enemy's riflemen were hovering about with your rifle shells for their ammunition. Your second experiment of firing entire cartridges from the carbine with the percussion caps of Manton (6), were also successful in every case, both with cartridges in paper and in linen (7); by this the motion of biting the cartridge being saved, time is saved in loading, and the entire charge, without the usual waste, is always delivered into the piece. Your percussion grenade (8), by being thrown out of the window of our model room into the parade court below, exploded on both occasions, proving its superiority to the fuse grenade, and its suitability for defence of houses, castles, flanked ditches, &c. I am glad that all our cadets saw these successful experiments, as I feel assured that sooner or later your views must be adopted. —HECTOR STRAITH."

(1). That the same law which governs a one-pounder rifle cannon applies also to rifle cannon of a larger size. The long range of 7000 yards lately obtained with an elongated shot from a breech-loading 68-pounder rifle cannon at Shoeburyness proves that my remarks were well founded. This breech-loading rifle cannon would do good service with elongated shells charged with the liquid fire—phosphorus dissolved in bisulphate of carbon.—J. N.

(2). This letter suggested the rifling of a six-pounder to try experiments with rifle shells, stating that I made successful experiments with the rifled one-pounder, which I requested might be lent me, and which, on refusal, I afterwards purchased.

(3). Names of authors.

(4). Some of the shells are charged with percussion powder, which is ten times stronger than gunpowder.

(5). These shells were taken out of a basin of water to show that they are waterproof; they are also fire-proof.

(6). Joseph Manton's plugs; the Ordnance caps also answer.

(7). The experiments made at Woolwich with these cartridges, constructed of fine flannel, were reported by the Select Committee to be perfect.

(8). Sir B. D'Urban, the present governor at the Cape, has, in a printed circular, dated Aug. 12, 1835, commanded these grenades to be used in the war with the Kaffirs.

ENGLAND TO CHINA IN SIXTEEN DAYS.

[FROM A CORRESPONDENT.]

Some excitement is now caused by a proposal to bring China within 16 days' journey of England, but upon reference to the *Mining Journal*, some 14 years since, it will be seen that a proposition was made by Mr. S. B. Rogers, of Nant-y-Glo, who published a pamphlet in 1844, entitled "Propositions in aid of constructing and safely working on a plan to ensure (without risk) a return of 7½ per cent. per annum for whatever amount of capital may be employed, 10,000 miles of railroad, &c., to connect, with the exception of the short sea passage to Antwerp or Flushing, London with Canton in China (a 12 days' journey only), with ramifications to all the principal cities, towns, and works of Europe and Asia, and to many in Africa also, if thought desirable, by means of which roads a daily post and free intercourse, commercial, social, and philosophical, may be established and permanently maintained over a population of from 600,000,000 to 700,000,000 of people, and the blessings of real civilisation thus spread over the globe." The "seven new principles of action promulgated in the pamphlet" are that companies for accomplishing great and important undertakings may be formed and profitably worked without risk of loss or fear of disappointment, either from broken contracts, realising results, engineering charges, fluctuations in the value of labour or materials, wear and tear, or any contingent or accidental expenses whatever; and also without parties incurring individual responsibilities or forced associations of any kind; that capital to any amount, even up to 100,000,000*l.*, may be readily raised by five or six of the existing London bankers alone, without parliamentary or any other legal powers than the present laws of the country afford; and such capital may be invested in real property, so as to return an immediate and permanent interest of 7½ per cent. per annum; that all squabbles, lawsuits, gambling, and many other of the disagreeable, vicious, and expensive occurrences which so frequently arise under the present crude and imperfect modes of managing joint-stock concerns may be entirely obviated, and that with complete satisfaction to all parties concerned in such undertakings, as well as to the public at large; that a new banking or discounting establishment may be formed that would realise on the capital stock of 100,000,000*l.* (all safely and reproductively invested in real property) from 1,500,000*l.* to 2,000,000*l.* a year nett, without fear of incurring a loss of any kind; that a new medium of exchange may be originated on a basis of real property far superior in every respect to Exchequer Bills or any existing security of the sort; that undertakings established on the principles in question, be they ever so extensive either as to capital or operations, need not consist of more than six persons, although hundreds or thousands of individuals may partake of the benefits of such concerns; and that the proposed roads and their stations and borders would form a neutral ground for all mankind to meet and act upon in the most comprehensive meaning of the terms free trade and rational freedom, whereby would be opened out an entirely new and greatly improved era in the affairs of mankind. Mr. Rogers's project was too startling to obtain the support it required, but from the improvements which he has introduced into the manufacture of iron, there is good reason to believe that he would carry out what he proposes. His "Iron Metallurgy" has been well received both by the trade and the public, and, doubtless, had he the opportunity of developing his ideas more completely, the world at large would benefit; for nothing can be truer than the words on the title page of his pamphlet, that "the wise and active conquer difficulties by daring to attempt them; but sloth and folly shiver and shrink at the mere sight of toil and hazard, and actually *make* the impossibilities they fear."

RAILWAY ECONOMY.—To secure the greatest economy, lowness of price must only be considered in conjunction with excellence of quality, for it does not always follow that because the cost of manufacture by a given process is trifling that such process is worthy of adoption. An invention of great utility, and in which this fact has been kept well in view, has recently been patented by Mr. W. G. Craig, of Gorton, Lancaster. It refers to that class of wheels formed of cast metal, or having cast metal naves or bosses, principally intended to be secured on an axle such as railway carriage wheels. The object of the invention is to cast the hole in the nave in which the axle is fixed, and also the key-bed for securing the wheel to the axle, so accurately and true as to dispense with the boring and key-bed cutting, which is indispensably necessary when the nave is formed by the ordinary mode of casting. The invention consists in an improved core, arrangements being made which enable the core to be placed and maintained in a correct position while the wheel is cast, the result being a very perfect wheel at a considerably lower price.

ELECTRIC TELEGRAPHS.—In the ordinary systems of telegraphing, the necessity for several wires is avoided by the repetition of the simple signal twice or thrice. By this and other well known means, various compound signals are made for several single and simple letters of the alphabet, numerals, cyphers, and other symbols, the use of one wire only, or the combinations resulting from the use of two or only a few wires, being sufficient for clearly and satisfactorily establishing a complete alphabet or code of signals as may be required. In transmitting or forming such compound signals with the instruments usually employed, it is necessary to make the two or more simple signals of which they are composed, by two or more corresponding mechanical efforts on the handles, or other manipulating portions of the instruments. This complaint does not hold good with regard to Bains's telegraph, but that system has an equally great defect; although great rapidity is gained in the actual formation of the signals, the preparation causes much trouble and loss of time. Mr. Frederick Priestley, of Berners-street, has patented an invention which entirely overcomes all difficulties, and offers the advantages of Bains's system, not in respect of a continuous message, but in respect of the several separate compound signals which may require to be made, by simplifying the manipulation or work to be performed by the operator in the transmission or formation of such signals, and consists in constructing electric telegraphic signal instruments with a series of handles, keys, or other manipulating portions for producing various compound signals, in such manner that one mechanical effort of the operator exerted upon any one of such handles, keys, or manipulating portions shall transmit or form the several simple signals, of which the particular corresponding compound signal is composed. Under the usual system of either the single needle or the double needle telegraph, a compound signal, consisting of three movements of one of the needles, either to the right or left, would require three correspondiug mechanical movements to be given to the handles of the instrument, for the purpose of three several times making and breaking the electric circuit. But under his improved system the pressure once only upon a single key will make and break the circuit as required. A telegraphic signal instrument adapted for transmitting a complete alphabet or code of signals will consist of a series of such keys and apparatus as above described, but it is to be understood that into or amongst the said series keys for transmitting or making simple signals (as heretofore practised) may also be introduced. The same description of instrument is also applicable to, and may be used in connection with, the recording instruments employed under Morse's and Bains's systems of electric telegraph. To prevent misapprehension, he remarks that his invention is in some respects similar to the ordinary "step by step," or "dial" signal instruments, by which different compound signals are transmitted or formed by making and breaking contact, &c., a varying number of times, according to the degree or amount to which the dial is turned round (or the wire moved round, over, and upon the dial). Nevertheless, his invention possesses a distinct feature of novelty as contrasted with such instruments, inasmuch as the latter do not provide a separate or distinct movement in respect of each different compound signal, but require the same movement in every case, varying only in the extent or degree to which it is to be made.

DRY PRINTING.—A new paper has been made with prepared albumen from the residue of the beet root after distillation and the manufacture of sugar, which has been patented by the inventor, Dr. Collyer. The great peculiarity of this paper is that it can be printed on without "wetting." The impressions which we have seen worked off by steam-power of one of the most extensively circulated illustrated periodicals exhibit a sharpness and clearness of outline which was equal to the impressions that were being taken on the damped paper. The same results take place with lithographic, steel, and copper engravings. The surface of the paper is smooth, compact, and vellumy. The prepared albumen can be used in the manufacture of paper in from 20 per cent. or as high as 80, dispensing with the use of the same proportion of rags. It has a great advantage over glycerine, as it is less than half the expense, and forms a component part of the paper itself. The prepared albumen carries its sizing properties, which enables the manufacturer to dispense with the use of resin or animal size. It has been adopted by Her Majesty's Government in the manufacture of cartridge cases at the Royal Paper Factory, Woolwich. We are of opinion that Dr. Collyer's patent material will become a most important feature in the future manufacture of paper. We believe a company is in contemplation.

PRACTICAL MECHANICS.—We have, on many occasions, alluded to the excellent treatises published, by Messrs. Griffin, in the "Encyclopædia Metropolitana," and the last volume issued will undoubtedly add to the reputation of the work. It consists of a "Manual of Applied Mechanics,"* by Professor Macquorn Rankine, President of the Institution of Engineers in Scotland, &c., which cannot fail to be generally adopted as a text-book on the subject. The professed object of the book is to set forth, in a compact form, those parts of the science of mechanics which are practicably applicable to structures and machines. The treatise comprises the principles of statics, cinematics, and dynamics, and the theory of structures, mechanism, and machines, in a thoroughly interesting form—there is certainly all the information a practical man is likely to require, and precisely in the style in which he requires it. A branch of mechanics not usually found in elementary treatises is lucidly explained—that which relates to equilibrium of stress, or internal pressure, at a point in a solid mass, and to the general theory of the elasticity of solids. It is the basis of a sound knowledge of the principles of the stability of earth, and of the strength and stiffness of materials. The correct laws of the flow of elastic fluids (first investigated by Drs. Joule and Thompson) and the true equations of the action of steam and other vapours against pistons, as deduced from the principles of thermodynamics, by Professors Clausius and Rankine, contemporaneously, are for the first time stated and applied in an elementary manual. It may be remarked that Professor Rankine's work is by no means of the ordinary stale, dry character of the elementary treatises usually placed in the hands of students, and that the whole of the information is so admirably arranged that there is every facility for reference. Such is the brief description of the work; but we shall take a future opportunity to refer more fully to its merits.

* *Manual of Applied Mechanics.* By W. J. MACQUORN RANKINE, L.L.D., C.E., F.R.S., &c. London and Glasgow: R. Griffin and Co.

PROPELLING VESSELS.—Alfred Count de Bylandt provisionally specified an invention which consists in adapting a series of plates of metal or blades at the submerged part of ships, the said plates being so arranged as to leave space between each pair for the passage of air, which it is intended to force between them by a steam-engine. The pipes for the passage of the air from the interior of the ship may be near the keel, so long as it enters at the bottom of the aforesaid plates, which also incline towards the stern; this arrangement is for propelling the vessel ahead. An ordinary screw must be used to propel it astern.

PROPELLING VESSELS.—Mr. Owen, Wolverhampton, provisionally specified an invention which consists in propelling vessels by the use of long plates of metal immersed in the water, and to which plate or plates of metal an undulating or wave-like motion is communicated by steam or other motive-power. He attaches the bands or long plates to the vessel in such a manner that they are perfectly free to take the undulatory motion described, the said motion being given by connecting the plates at one end to the piston-crank, or other suitable part of the motive-power engine. He does not limit himself to any particular position of the undulating bands, but he prefers to place them at the sides of the vessel, and he sometimes encloses them in a tube, open at both ends, the said tube passing through the vessel at or near the axis of the said vessel. He sometimes places broad flanges or plates on either side of the vessel, and immediately over the undulating plates when they are in the sides of the vessel. The said flanges bear or ride upon the crests of the waves, and give to the vessel a steady skimming motion.

SUPERHEATED STEAM.—The apparatus recently introduced by Mr. D. Partridge, at Woolwich, having been specially ordered by the Lords of the Admiralty to be fitted on board Her Majesty's troopship *Dee*, employed on particular service, has been tested under the superintendence of Mr. Taplin. The *Dee* left Woolwich at one o'clock on Monday, and steamed down the river, returning on Tuesday evening at seven. Capt. Sasse, a Swedish naval officer, accompanied the vessel, by permission of the Admiralty, in order to witness the trial, the result of which was reported as follows:—The economy in fuel alone amounted to from 25 to 30 per cent.; and, together with the additional power obtained by the lesser quantity of coals, realizes an advantage of upwards of 38 per cent. in favour of the use of superheated steam. The consumption of coals with superheated steam amounted to about 980 lbs. per hour, and with plain or ordinary steam to about 1370 lbs., showing a difference in the consumption of fuel in each successive hour of 390 lbs. The nominal power of each engine is 100 horses.

ERICSSON'S HOT-AIR ENGINE.—This indefatigable inventor of the hot-air engine has not permitted the quarter of a century's fruitless exertions which he has made to discourage him; another improvement being described in the last number of the *Scientific American*. It is a horizontal single-acting engine, with one cylinder, which fulfils the office of feed pumps, prime mover, heater, and air chamber. Although each is complete in itself, any number may be yoked to one shaft; though single-acting and horizontal, it communicates a very equable motion to a main revolving shaft—a result very difficult to accomplish. It may be supposed by some persons that the feed of the cold air will be comparatively slow, but air rushes into vacuo at the rate of 1300 ft. per second, 100 times the velocity of our fastest steam-engines. It cannot carry such a high pressure as a steam-engine, but it is asserted that although air requires to be heated to about 500° Fahr. to double its volume and exert a pressure of 15 lbs. on the square inch, that a much higher pressure has been carried in these engines without injury to any of the parts by a high temperature. In regard to a variable increase of power, this has not the flexibility of the steam-engine. Thus a non-condensing steam-engine, if its boiler be sufficiently large and strong, can be worked at from 30 to 100 lbs. pressure, with a triple increase of power from the highest to the lowest pressure. This flexibility is very necessary and convenient in some factories where there are several machines that have to be stopped at intervals of some days, while others are kept running. But for constant small portable engines, capable of being applied to a great number of useful purposes, such as pumping water, driving portable grain mills, &c., the caloric engine appears to be safe and convenient. Any boy or labourer who has sense enough to kindle and take care of a fire can take care of the engine; the fire has but to be kindled, and in about 10 or 15 minutes it will be ready to run. If left to itself it will stop when the fire goes down, and neglect cannot cause an explosion, because a charge of air has to be heated for each stroke.

AUSTRALIA—"WHITE STAR LINE."—This noble fleet of vessels, sailing between Liverpool and Melbourne, still keep extending in numbers and importance. H. T. Wilson and Chambers, the owners of the line, are the fortunate possessors of some of the most magnificent clippers the world has ever seen; vessels built for and owned by themselves, and fitted with every care and attention to the health, comfort, and safety of passengers, including the renowned *Red Jacket*, the matchless *White Star*, the *Golden Era*, *Shalimar*, and others almost equally celebrated. They intend to dispatch on June 20 the model clipper-ship *Invincible*, Capt. Johnson, of 5000 tons burden. This faultless clipper, like her compeer, the *Red Jacket*, is a truly clipper ship, combining the clear and ample deck space of the man-of-war with the wedge like bow and run of the fastest steamers. Her speed is marvellous, often accomplishing 360 miles and upwards per day, whilst her uniform passages present a regularity of speed unparalleled in the annals of navigation. She has made eight passages to and from Australia in from 71 to 75 days, having never been 76 days at sea on any voyage. Her last run home was in 72 days, on which occasion she beat every ship and steamer of the season. Her saloons, of which she has two, are sumptuously furnished. Her second cabin, intermediate, and steerage accommodations are unique, whilst in space, deck room, light, and ventilation, she has no equal in port. The *Invincible* sails at noon on June 20; and the same firm intend dispatching the *Red Jacket* on July 20, and the mammoth clipper, *White Star*, on Aug. 20.

NEW MACHINERY FOR THE LIVERPOOL DOCKS.—The Mersey Dock board have accepted the tender of Messrs. Pickup and Buchanan, for the construction of a 50-horse high-pressure engine for 1256*l.* 10*s.* The dock engineer was also directed to communicate with Messrs. Nasmyth, Manchester, with a view to obtain a steam piling-engine.

CUBIC FEET OF GAS PER POUND OF COAL.—At the Philadelphia Gas Works, in the year 1857, the largest quantity of gas from each pound of coal, made for any full day's work, was—

At the works in the First Ward, below Gray's Ferry	4·83 feet.
At the works in the Ninth Ward, at the Permanent Bridge	4·64 "
At the works in the Fifteenth Ward, near the Wire Bridge	4·60 "
Average yield of cubic feet of gas per lb. of coal at the three works..	4·69 "

—*U. S. Railroad and Mining Register.*

MANUFACTURE OF COAL OIL IN AMERICA.—Mr. J. E. Holmes, Newark, Ohio, has furnished to the *Scientific American* some valuable statistics in relation to the manufacture of coal oil in that region, from the fine quality of cannel coal which the surrounding country produces. "The first establishment for the manufacture of coal oil in this portion of Ohio was started some two years since, by Dillie and Robinson, Perry county, who have recently increased their works to such an extent as to enable them to manufacture about 350 gallons of oil per day, a more than usual proportion of which is burning oil of superior quality. The vein of coal from which their works are supplied is of an excellent quality, but, like most good coal beds, very thin. In addition to this, the senior member of the firm is making arrangements to start similar works at Flint Ridge, in Licking county, which will be supplied by the extensive and available vein now in possession of the Great Western Oil and Coal Company, of Newark, Ohio. The latter company furnish Newark with gas, which is said to be unsurpassed for its brilliancy, and will soon be prepared to produce 1000 gallons of oil per day. The Newark Coal Oil Works under the management of Messrs. Holmes and Hull, are also increasing the capacity of their works; and we are assured by the first-named proprietor that they will shortly be able to produce 300 gallons of pure oil per day. The demand for this kind of oil, both for burning and lubricating purposes, would seem to justify the assertion that it will be generally used for both. It possesses but little odour, is of the same specific gravity as water, and is limpid in appearance. Mr. Holmes says that a single application of this oil to the slides of a large iron planer, having a travel of 20 ft., and a width of 4 ft., lasted a whole week. It appears that one portion of the fissures or fractures in the beds of cannel coal situated in Central Ohio, have one general direction or bearing, which is about 5° west of south, the blocks being nearly square, and varying from 2 to 3 ft. This fact led Mr. Holmes to suppose that, at the time the deposit was hardening into coal, the magnetic attraction of the pole might have some influence in producing this peculiarity. This observation has been made in the fissures of all coal beds, and they run in the same direction nearly all over the world. We do not profess to account for this, but we should not like to attribute it to polarity."

COLT'S REVOLVERS.—A series of experiments has recently been made at Washington, U.S., which must be regarded as conclusive evidence of the excellence of Col. Colt's revolving-chambered, breech-loading fire-arms. There were three specimens of his pistol-carbine, of 12, 15, and 18 in. barrel, and one pistol with 7½ in. barrel. To test the penetration of these arms a target of white pine boards, seasoned, 1 in. thick, with an interval of 1¼ in. between the boards, and 2 ft. by 2 ft. in size, was used. The shots were fired at 30 yards. The carbine with 12 in. barrel penetrated 9 boards; that with 15 in. barrel, 8½ boards; and that with 18 in. barrel, 9 boards; the pistol penetrated 7½ boards. The board recommended the adoption of Colt's pistol and ammunition for the cavalry service, and that each trooper be furnished with two pistols, one to be worn on the soldier's right side, in a pouch attached to his sabre belt, and the other in the holster on the right side of the saddle. The board considered that Colt's arms were superior in every respect to all others.

THE LONDON, NORWICH, AND BECCLES CRAPE AND SILK WORKS COMPANY.—Amongst the new speculations recently started is a company having for its object the winding, re-winding, and throwstering of silk, and for manufacturing the same into crape and other textile fabrics. It is stated that there is no article of such general consumption as crape so restricted in its manufacture, and that the demand is now greater than the supply. One argument used to prove that the present is a favourable time for the commencement of operations, is the fact that the silk market is now returning to the natural average quotations, and the supply from India and China rapidly increasing. The company will be in a position to commence business immediately, as they have made arrangements upon advantageous terms for the purchase of a crape factory and machinery, now in operation at Norwich, having an existing connection with some of the largest wholesale houses in the kingdom. The promoters have also made provisional arrangements with the Beccles Silk Works Company, and it is calculated, with adequate capital, the two works could manufacture upwards of 40,000*l.* worth of crape yearly. The company will be registered under the Joint-Stock Companies Act, 1856, with limited liability. The proposed capital is 20,000*l.*, in 2000 shares of 10*l.* each. The provisional directors are gentlemen practically acquainted with the trade.

GUTTA PERCHA BANDS, TUBING, &c.—Our BANDS, carefully MANUFACTURED from the VERY BEST GUTTA PERCHA only, are considerably CHEAPER, and, when fairly worked, are far more DURABLE than LEATHER. Can be had in lengths of 100 or 120 feet without a joint, are easily joined or repaired, and are, when worn out, re-purchased by us at about one-third of their original cost. In the event of a break down, a band of any size can be supplied within a few hours of receipt of order. The present prices are as under:—

Bands ⅛ in. thick and upwards to ½ in. .. 2s. 0d. per lb.
Bands above ½ in. thick..... 2s. 2d. per lb.

Subject to a liberal discount for cash, varying according to quantity. TUBING and other articles equally low. All our patented manufactures are to be obtained wholesale from our own works; retail from any of our dealers.

THE WEST HAM GUTTA PERCHA COMPANY.
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